The African Organisation for Standardisation

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ARS 831 (2012) (English): Fresh bananas -- Specification

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AFRICAN STANDARD

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Fresh bananas — Specification

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Foreword

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This African Standard was prepared by the ARSO Technical Harmonization Committee on Agriculture and Food Products (ARSO/THC 1).

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Introduction

Bananas form an important part of trade across the borders of Africa as well as international trade. This standard has been developed to facilitate this trade by emphasising on the quality factors and grading of bananas to attract commensurate pricing.

Fresh bananas — Specification

1 Scope

This Standard applies to commercial varieties of bananas grown from *Musa spp*. of the *Musaceae* family, in the green state, to be supplied fresh to the consumer, after preparation and packaging.

Bananas intended for cooking only (plantains) or for industrial processing are excluded. Varieties covered by this Standard are included in Annex A.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ARS 53, *General principles of food hygiene — Code of practice*

ARS 56, *Prepackaged foods — Labelling*

CAC/RCP 44, *Recommended international code of practice for the packaging and transport of tropical fresh fruits and vegetables*

CAC/RCP 53, *Code of hygienic practice for fresh fruits and vegetables*

CODEX STAN 193, *Codex general standard for contaminants and toxins in food and feed*

ISO 874, *Fresh fruits and vegetables — Sampling*

3 Definitions

For the purpose of this standard the following definitions apply:

3.1
blemish
any physical injury affecting the surface of the fruit, such as scars, healed cracks and discoloured spots, which detracts from its natural appearance, but will not significantly affect its shelf life

3.2
clean (visual)
the fruit shall be free from adhering soil, insects, chemical deposits and other foreign matter

3.3
cluster
part of a hand of bananas, normally distributed in two finger or five finger fruits

3.4
correct length
outer whorl fingers adjacent to cut side of the cluster, measurement of pulp from end to the base of pedicel on outer curve of the finger, found to be less or more than that specified based on market requirements

3.5
damage caused by pests
clusters showing cured damage to the peel due to the feeding or nesting of pests such as slugs, caterpillars, rodents or birds.

3.6
deflowered
the removal of the flower ends attached to clusters

3.7
disease
any defect or combination of defects caused by micro-organisms

3.8
finger end rot
abnormal constriction at the blossom-end and blackening of the pulp when split open

3.9
firm
not soft or shrivelled

3.10
fresh
clusters showing coloured crowns or pedicels or fruits which are not dehydrated

3.11
fused fingers
two or more fingers joined together

3.12
malformed finger
a unit or fingers on a cluster which do not conform to the general physical characteristics of the banana

3.13
turning
clusters showing yellowing of the pulp of a finger

4 Provisions concerning quality

4.1 General

The purpose of the standard is to define the quality requirements for bananas at the market control stage, after preparation and packaging.

The holder/seller of products may not display such products or offer them for sale, or deliver or market them in any manner other than in conformity with this standard. The holder shall be responsible for observing such conformity.

4.2 Minimum requirements

4.2.1 In all classes, subject to the special provisions for each class and the tolerances allowed, the bananas must be:

a) whole (taking the finger as the reference);

b) sound, produce affected by rotting or deterioration such as to make it unfit for consumption is excluded;

c) clean, practically free of any visible foreign matter;

d) practically free of pests affecting the general appearance of the produce;

e) free of damage caused by low and/or high temperatures;

f) free of abnormal external moisture, excluding condensation following removal from cold storage, and bananas packed under modified atmosphere conditions;

g) free of any foreign smell and/or taste;

h) firm;

i) fresh in appearance, not affected by rotting;

j) free of damage caused by low temperatures;

k) practically free of any conspicuous bruises;

l) free of malformation or abnormal curvature of the fingers;

m) with pistils removed (deflowered);

n) normal in shape of fruit and pedicel that the pedicel is not damaged due to fungi or desiccation;

o) practically free of pests affecting the general appearance of the produce

p) practically free of damage caused by pests, excluding those affecting its eating quality

q) practically free from blemishes

r) free from ripe and turning

s) free from fused fingers

t) free from finger end rot

u) of the correct length

4.2.2 In addition, hands and clusters must include:

a) a sufficient portion of the crown of normal colouring, sound and free of fungal contamination;

b) a cleanly cut crown, not bevelled or torn, with no stalk fragments.

4.2.3 The development and condition of the bananas must be such as to enable them:

— to reach the appropriate stage of physiological maturity corresponding to the particular characteristics of the variety;

— to withstand transport and handling; and

— to arrive in satisfactory condition at the place of destination in order to ripen satisfactorily.

4.3 Classification

Bananas are classified in three classes defined below:

4.3.1 “Extra” Class

Bananas in this class must be of superior quality. They must be characteristic of the variety and/or commercial type. The fingers must be free of defects, with the exception of very slight superficial defects, provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package.

4.3.2 Class I

Bananas in this class must be of good quality. They must be characteristic of the variety. The following slight defects of the fingers, however, may be allowed, provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package:

- slight defects in shape and colour;
- slight skin defects due to rubbing and other superficial defects not exceeding 2 cm^2 of the total surface area.

The defects must not, in any case, affect the flesh of the fruit.

4.3.3 Class II

This class includes bananas which do not qualify for inclusion in the higher classes, but satisfy the minimum requirements specified in 4.2. The following defects, however, may be allowed, provided the bananas retain their essential characteristics as regards the quality, the keeping quality and presentation:

- defects in shape and colour, provided the product retains the normal characteristics of bananas;
- skin defects due to scraping, scabs, rubbing, blemishes or other causes not exceeding 4 cm2 of the total surface area.

The defects must not, in any case, affect the flesh of the fruit.

5 Provisions concerning sizes

5.1 For the purposes of sizing bananas of the Gros Michel and Cavendish sub-groups, the length of the fingers is determined along the outside curve from the blossom end to the base of the pedicel where the edible pulp ends and the diameter is defined as the thickness of a transverse section between the lateral faces. The reference fruit for measurement of the length and grade is:

- for hands, the median finger on the outer row of the hand;
- for clusters, the finger next to the cut section of the hand, on the outer row of the cluster.

5.2 The minimum length should not be less than 14.0 cm and the minimum grade not less than 2.7 cm.

5.3 Fruit Selection Method for Measurement of the Length and Diameter:

In case of hand, a single fruit or any finger of a couple at the middle of the hand, on the outer row of the cluster is selected.

In case of cluster, a single fruit next to the cut section of the hand, on the outer row of the cluster, is selected. If the cluster has 2 cuts, take the average of the fingers next to the cuts, on the outer row.

5.4 Method for Size Measurement.

- The length is determined along the outside curve from the blossom end to the base of the pedicel.
- The diameter is defined at the widest part of the finger.
- The weight is calculated that the weight of the hand is divided by the number of fingers.

6 Provisions concerning tolerances

Tolerances in respect of quality and size shall be allowed for produce not satisfying the requirements of the class indicated.

6.1 Quality tolerances

6.1.1 “Extra” Class

Five percent by number or weight of bananas not satisfying the requirements of the class, but meeting those of Class I or, exceptionally, coming within the tolerances of that class.

6.1.2 Class I

Ten percent by number or weight of bananas not satisfying the requirements of the class, but meeting those of Class II or, exceptionally, coming within the tolerances of that class.

6.1.3 Class II

Ten percent by number or weight of bananas satisfying neither the requirements of the class nor the minimum requirements, with the exception of produce affected by rotting, major imperfections or any other deterioration rendering it unfit for consumption.

6.2 Size tolerances

For all classes, 10% by number or weight of bananas not satisfying the requirements as regards sizing, but falling within the size immediately above or below.

7 Provisions concerning presentation

7.1 Uniformity

The contents of each package must be uniform and contain only bananas of the same origin, variety, and quality. The visible part of the contents of the package must be representative of the entire contents.

7.2 Packaging

Bananas must be packed in such a way as to protect the produce properly. The materials used inside the package must be new[1], clean, and of a quality such as to avoid causing any external or internal damage to the produce. The use of materials, particularly of paper or stamps bearing trade specifications is allowed, provided the printing or labelling has been done with non-toxic ink or glue.

Bananas shall be packed in each container in compliance with CAC/RCP 44.

7.2.1 Description of containers

The containers shall meet the quality, hygiene, ventilation and resistance characteristics to ensure suitable handling, shipping and preserving of the bananas. Packages must be free of all foreign matter and smell.

7.3 Presentation

— The bananas must be presented in hands and clusters (parts of hands) of at least four fingers. Bananas may also be presented as single fingers;

— Clusters with no more than two missing fingers are allowed, provided the stalk is not torn but cleanly cut, without damage to the neighbouring fingers;

— Not more than one cluster of three fingers with the same characteristics as the other fruit in the package may be present per row.

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[1] For the purposes of this Standard, this includes recycled material of food-grade quality.

8 Marking or labelling

8.1 Consumer packages

In addition to the requirements of ARS 56, the following specific provisions apply:

8.1.1 Nature of produce

Each package shall be labeled “Banana” and/or “name of the variety” if the produce is not visible from the outside.

8.1.2 Net weight in grams or kilograms

8.1.3 Distributor information

Name and address of the distributor or packer or display of registered trade mark.

8.1.4 Origin of produce

Identify country of origin to prevent misunderstanding.

8.2 Non-retail containers

Each package must bear the following particulars, in letters grouped on the same side, legibly and indelibly marked, and visible from the outside, or in the documents accompanying the shipment.

8.2.1 Identification

Name and address of exporter, packer and/or dispatcher. Identification code (optional)[2].

8.2.2 Nature of produce

Each package shall be labeled “Bananas” and/or name of the “variety” if the contents are not visible from the outside. Name of the variety or commercial type (optional).

8.2.3 Origin of produce

Country of origin and, optionally, district where grown or national, regional or local place name.

8.2.4 Commercial identification

8.2.4.1 Type of bananas: single, cluster (number of fruits) or hands;

8.2.4.2 Class;

8.2.4.3 Size code (optional);

8.2.4.4 Units per package or net weight in grams or kilograms.

8.2.5 Official inspection mark (optional)

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[2] The national legislation of a number of countries requires the explicit declaration of the name and address. However, in the case where a code mark is used, the reference “packer and/or dispatcher (or equivalent abbreviations)” has to be indicated in close connection with the code mark.

9 Contaminants

9.1 Heavy metals

Bananas shall comply with those maximum levels for heavy metals established by the Codex Alimentarius Commission for this commodity.

9.2 Pesticide residues

Bananas shall comply with those maximum pesticide residue limits established by the Codex Alimentarius Commission for this commodity.

10 Hygiene

10.1 The produce covered by the provisions of this African Standard shall be prepared and handled in accordance with the appropriate sections of ARS 53 and CAC/RCP 53.

10.2 Harvest and various steps in banana handlings including storage and transportation must be hygienically practiced in order to prevent contamination which will be harmful to consumers.

11 Sampling and test

Sampling shall be done in accordance with ISO 874. Tests for pesticide residues, contaminants and toxins shall be conducted in accordance with the recommended methods of the Codex Alimentarius Commission.

Annex A
(informative)

List of the main groups, sub-groups and cultivars of bananas for dessert

Groups	**Subgroups**	**Main cultivar**
AA	Sweet-fig	Sweet-fig, Pisang Mas, Amas Date, Bocadillo
AB	Ney Poovan	Ney Poovan, Safet Velchi
AAA	Cavendish	Dwarf Cavendish Giant Cavendish Lacatan Poyo (Robusta) Williams Americani Valery Arvis
	Gros Michel	Gros Michel Highgate
	Pink Fig	Pink Fig Green pink Fig
	Ibota	
AAB	Apple Fig	Apple Fig, Silk
	Pome (prata	Pacovan Prata Ana
	Mysore	Mysore, Pisang Ceylan, Gorolo

Annex B
(informative)

Green bananas — Guide to storage and transport

B.1 Scope and field of application

This annex describes conditions for the successful keeping, with or without artificial cooling, of green bananas, Musa sp., in the preclimacteric phase during storage before transport from the place of production to the place of consumption and during maritime transport.

Bananas should be stored, before transport from the exporting country to the place of consumption and throughout the period of transport, in the green condition and, therefore in the preclimacteric phase.

A banana is said to be in the preclimacteric phase when the process of ripening has not yet been initiated.

Harvesting of bananas takes place throughout the year in tropical and sub-tropical regions having considerable variations of an ecological and climatic kind. It follows that the state of dimensional development (fullness) of the banana does not afford a precise criterion of its degree of ripeness. A thin banana (in a period of drought) may be in an advanced degree of ripeness.

Moreover, the degree of ripeness to be chosen depends on the duration of transport, which varies considerably (from a few days to 3 weeks).

The producer should time the cutting of the bananas so that the degree of ripeness (as estimated from their fullness) is compatible with the transport envisaged. The time of cutting therefore depends on two distinct factors: the duration of refrigerated transport and the physiological state of the banana. For this reason the recommendations for the degree of ripeness (see B.2.1) cannot be universally applicable and can be only of a general nature which serve as a pointer to the producer, who has to decide on his own criteria for cutting.

As regards examination for ripeness, a bunch of bananas may be likened to a bunch of grapes with fruit in different states of ripeness, and it is therefore essential to specify with what fruit the check is to be carried out.

The state of the bananas (state of health, wounds, etc.), when they enter the store, has an influence on the storage life, and this is the justification for making recommendations on this subject.

The same applies to the precautions to be taken between harvesting the bananas and putting them into the store. The high temperature of the producing areas and exposure to sunlight can appreciably reduce the storage life.

The term cultivar is used to indicate that the varieties of bananas entering into commerce are cultivated varieties.

Anti-fungal treatments of the ends of the main stalk or ends of the cushions have not been mentioned, because it is not possible to indicate treatments which are recognized beyond dispute.

B.2 Conditions of harvesting and putting into store

B.2.1 Harvesting

The degree of ripeness of the banana at harvesting should be determined as a function of its firmness and the number of days elapsing between harvesting and putting into the ripening room. It should not be too advanced, in order that the bananas may remain in the preclimacteric phase until they are put into the ripening room in normal conditions of transport.

B.2.1.1 Criteria of ripeness

The criteria of ripeness most generally used in practice are :

- the fullness, which is a dimensional criterion;
- the colour of the flesh, which is a criterion of the physiological state and is assessed by means of a conventional colour scale enabling a numerical value to be obtained;
- the firmness of the flesh, which is a criterion of the physiological state and is measured by means of a spring penetrometer (with a cylindrical end 4 mm in diameter, and a spring which is reduced in length by 100 mm under a force of 24.5 N);
- the characteristic odour of the flesh of the banana in the preclimacteric phase.

These criteria are not universally valid and, for each cultivar grown in the same way, they can vary from one region to another, and the producer should decide on his own criteria for cutting.

B.2.1.2 Examination for degree of ripeness

Examination for the degree of ripeness of a bunch of bananas should be carried out by using the representative fruit found in that part of the bunch which is in the most advanced state of ripeness, i.e. in the first or second hand reckoned from the largest end of the main stalk. The representative fruit is the centre fruit of normal shape in the inside row of the first or second hand. The degrees of ripeness of the fruits of the first and second hand can be considered as equal.

B.2.2 Quality characteristics for storage and transport

The bananas should be free from signs of attack by fungi, bacteria, insects or animal pests, and should be free from parasites. They should not be injured by fungal or physiological diseases.

In order to avoid the development of fungal diseases during storage, the fruit should be clean. It should not be stained with sap and the fruit stalks should be intact. The main stalk of the bunches should not show marks of sunburn and its two sections should be fresh, clean, and without smears, tears or breaks.

The bananas should be free from evident marks of rubbing, scraping, bruising or sunburn.

Removal of the pistils should be carried out in those producing areas where the climate and conditions of cultivation favour the development of rot. It should be carried out on the tree itself if the size of the banana tree allows this.

B.2.3 Putting into store

The bananas should be put into cold store for long journeys, or into ventilated store for short journeys, as soon as possible after harvesting. The interval between cutting the bunch and putting it into a refrigerated or ventilated enclosure (pre-refrigeration room, storage room or ship’s hold) should be less than 24 h if possible, and should not in any case exceed 48 h.

After harvesting and packaging, if the bananas are awaiting land transport to the port of embarkation, they should be put in the shade and in a well-ventilated place.

At the port of embarkation, the waiting time of lorries or wagons loaded with bananas, before transfer to the ship’s holds, should be reduced to the minimum and the vehicles should be in the shade.

B.2.4 Method of storage

Green bananas should be stored:

- in hands or portions of hands (clusters) in cartons;
- in bunches, in bags of perforated polyethylene;
- in bunches, enclosed in a protective mattress which allows gas exchange and has a thermal conductance sufficient to ensure satisfactory cooling (straw, paper, etc.);
- in uncovered bunches, arranged in bulk. This method of storage should be carried out with very great care in order to avoid damaging the bananas, which would lead to deterioration during transport and ripening.

B.3 Optimum storage and transport conditions (with artificial cooling)

Refrigerated storage and transport of green bananas comprises two phases: cooling and storage.

B.3.1 Cooling

B.3.1.1 Rate of cooling

Cooling of the bananas should be carried out as rapidly as possible. It depends on the following factors:

Cooling of the bananas should be carried out as rapidly as possible. It depends on the following factors:

- the power of the refrigeration plant (of the order of 700 to 800 calories per hour per tonne of bananas). With a central refrigeration plant, and loading of the banana vessel divided between two days, it is possible to apply the whole of the refrigerating power of the vessel to the first half of the cargo from the start of refrigeration and to dispose of more than 1 000 calories per hour per tonne of bananas;
- the air circulation ratio[1] in each ventilation section;
- the uniformity and speed of the air circulation across the load
- the surface of each package in contact with the cooling air;
- the efficiency of ventilation (effect of external and internal short-circuits of the air);
- the mode of packaging (polyethylene wrappers or carboard boxes of different kinds);
- the method of storage (compact or in stacks);
- the method of loading the banana vessel (continuously or in 2 days with an interval of 12 h at night).

B.3.1.2 Temperature

The temperature of the bananas is lowered from 25 to 30 °C, which is that of the bananas on loading into the ship’s holds, to the practical storage temperature (see B.3.2.1).

B.3.1.3 Relative humidity

The relative humidity of the air at the delivery side varies whilst the bananas are being cooled because the working range of the cold batteries is not stable. It increases at the end of cooling, when it should lie between 85 and 90 % at the entry of the delivered air into the banana compartments.

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[1] Air-circulation ratio is defined as the ratio of the volume of air passed in 1 h by the fans to the volume of the empty chamber.

B.3.1.4 Air circulation

An air circulation ratio of 80 to 100 per ventilation section (collection of compartments, usually two, depending on the same fan or fans) is recommended.

The ventilation system recommended is that with vertically ascending or descending air in series (two compartments superimposed and separate by a slatted floor), with a uniform distribution of air over the surface at the suction side or the delivery side. Each compartment is traversed by all the air delivered by the fans and consequently its air circulation coefficient is double that of the ventilation section.

The rate of air change[2] recommended is one change per hour, but it may be reduced to half a change per hour during cooling in order not to retard this.

B.3.2 Storage

B.3.2.1 Temperature

Throughout the period of maritime transport, after cooling of the bananas, it is necessary to ensure that the practical storage temperature of the delivery air is maintained at the value adopted. This is achieved by adding to the critical storage temperature (the temperature which induces damage to the bananas due to cold) a safety margin sufficient to take account of unavoidable temperature fluctuations arising fom the refrigeration plant and its operation (+0.2 to + 0.5 °C for a refrigeration plant using brine; +0.5 to +0.7 °C for a direct expansion plant).

The critical temperature for bananas is not constant, its value depending on the cultivar considered, on the degree of maturity of the crop, its sanitary state, and the duration of the maritime transport.

The following values are given as indications only:

Cultivar	**Period of storage** days	**Critical temperature**[3] °C
Gros Michel	12	12
Lacatan	11 to 13	14.4
Poyo (Robusta)	14	12
Grande naine (Giant Governor)	14	12
Petite naine (Dwarf Cavendish)	16	12

B.3.2.2 Relarive humidity

The surface of the air coolers should be designed so that a relative humidity of 85 to 90 % is obtained at the cold point of the refrigerated enclosure in the stabilization period when the cooling of the bananas is completed.

B.3.2.3 Air circulation

During storage, the air circulation ratio may be reduced to half after the end of the cooling period.

The recommended rate of air change is one change per hour.

B.3.2.4 Ripening

Ripening of the bananas during storage should be avoided by all possible means. Ripening is accompanied by an increase in the production of carbon dioxide and by the production of ethylene, which is liable to trigger the ripening of the adjacent bananas.

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[2] The rate of air change is the ratio of the volume of outside air introduced into the refrigerated enclosure in 1 h to the volume of the empty enclosure.

[3] Critical temperature is the temperature from which or below which, for a given period of storage, physiological disorders are produced or it is not possible to obtain normal ripening when the product is taken out of storage.

Experience in storage shows that with an efficient ventilation system, ensuring continuous sweeping of all parts of the load by the air circulating in the holds of banana vessel, and with continuous changes of fresh air, carbon dioxide and ethylene can be removed without any action on the adjacent fruit.

The occurrence of an abnormal percentage of ripe bananas on discharge of the banana vessel arises from four causes which should be avoided:

- keeping at ambient temperature at the port of arrival;
- loading of bananas at too advanced a stage of ripeness;
- defects in ventilation;
- defects in the refrigeration plant.

Annex C
(informative)

Examples of bananas

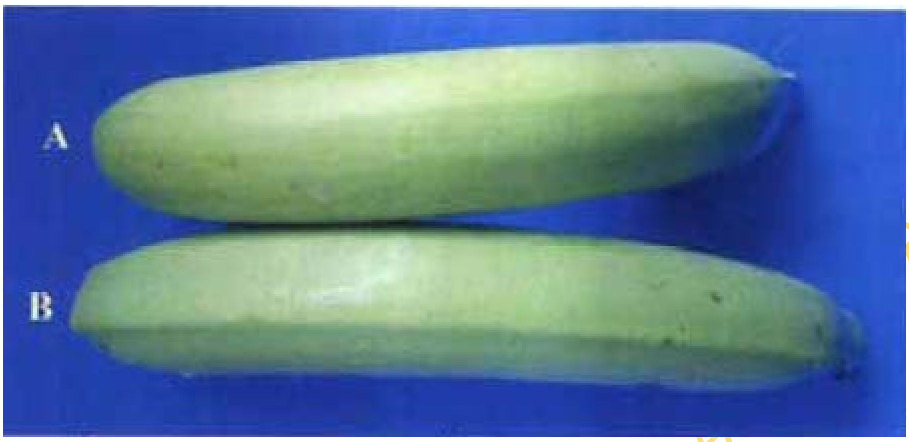

Figure C.1 — Characteristics of a fully (>90%) mature banana. The fruit is round, not angular (A) and an angular fruit is obvious on 80% mature banana (B)

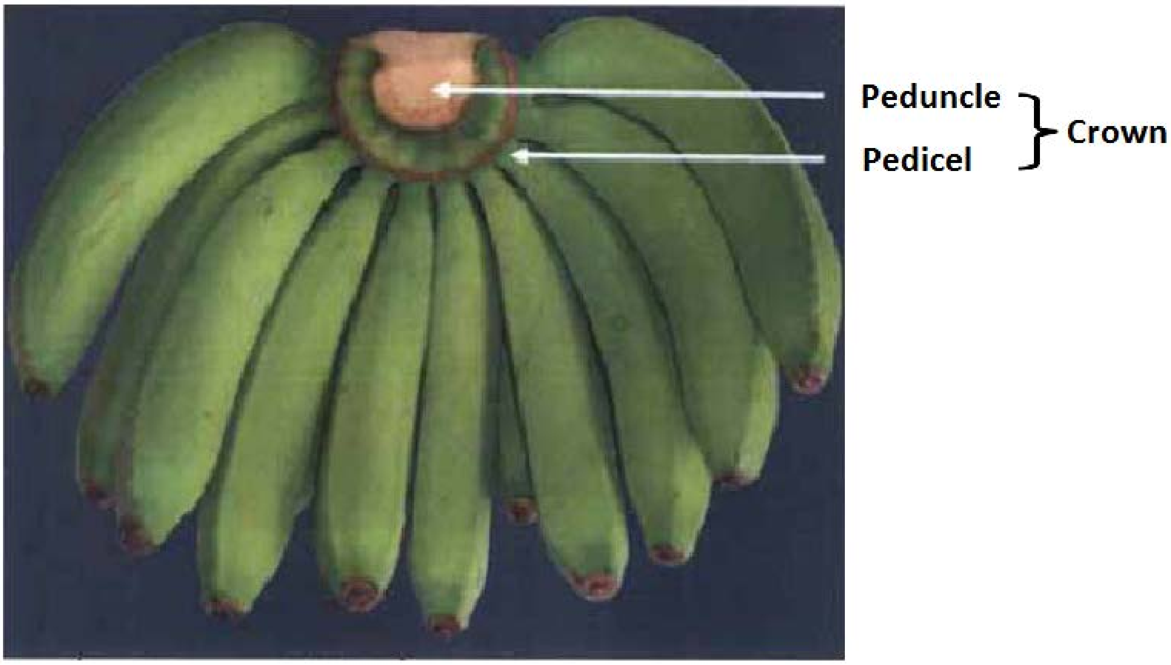

Figure C.2 — Characteristics of a perfect hand of bananas

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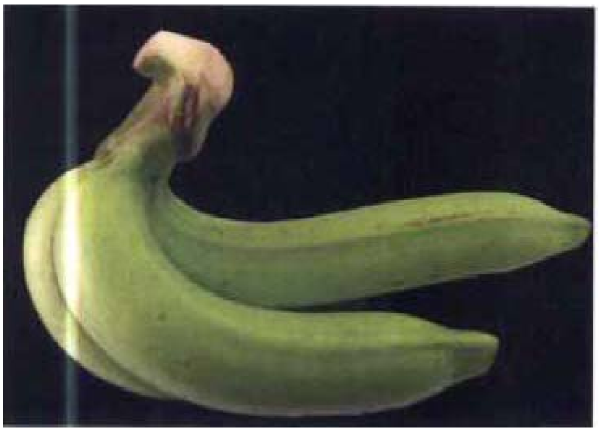

Figure C.3 — Characteristics of a cluster

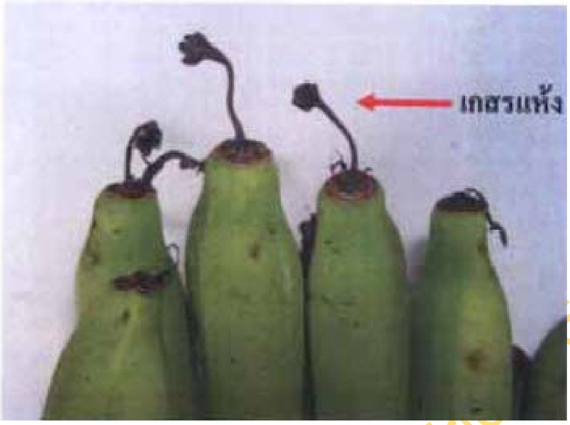

Figure C.4 Withered floral parts attached to the fruit end

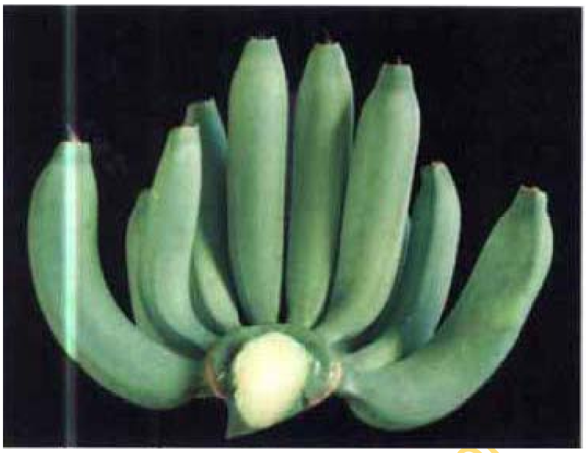

Figure C.5 — Different size fingers in a hand

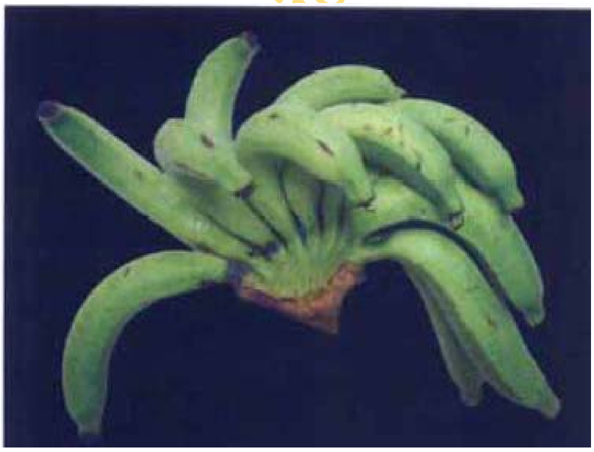

Figure C.6 Irregular arrangement of fingers in a hand

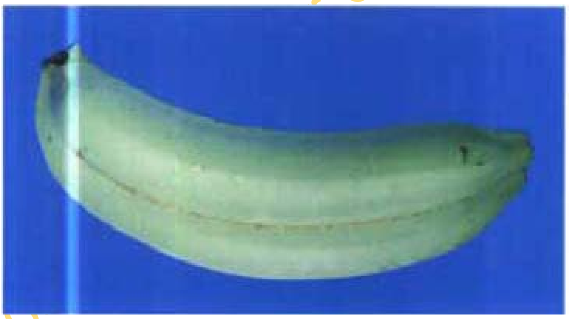

Figure C.7 — A double finger

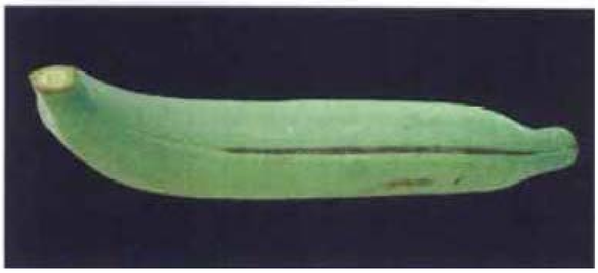

Figure C.8 A cracked finger

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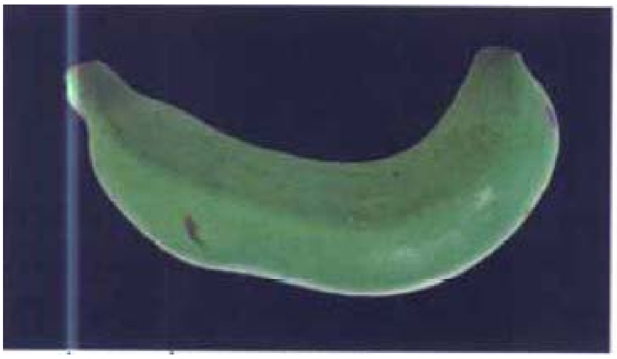

Figure C.9 — A malformed finger

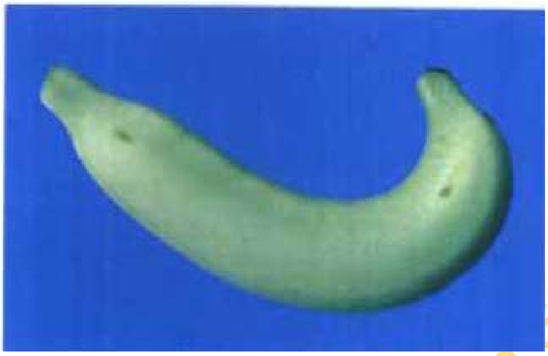

Figure C.10 A twisted finger

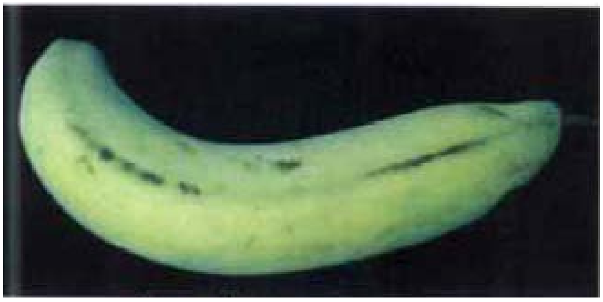

Figure C.11 — A bruised finger

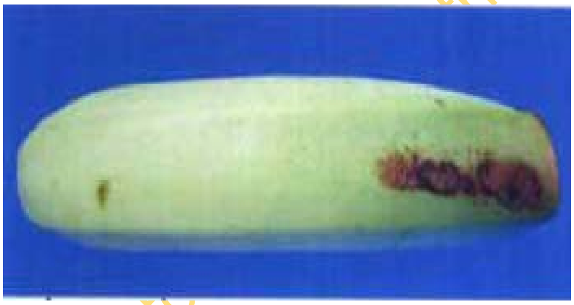

Figure C.12 A finger with sunburn on skin

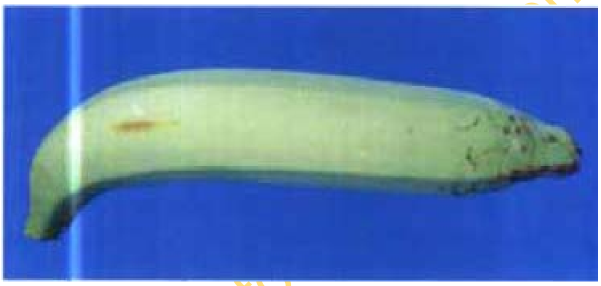

Figure C.13 — A finger damaged by birds

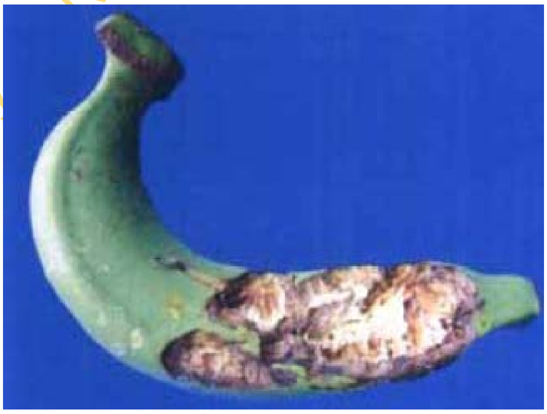

Figure C.14 A finger damaged by rodents

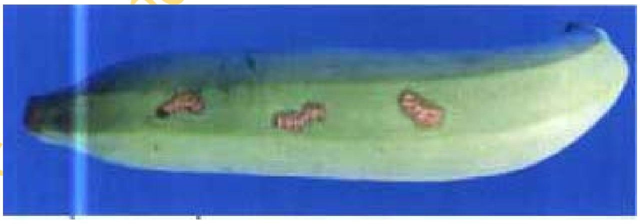

Figure C.15 — A finger with scars due to lady beetles

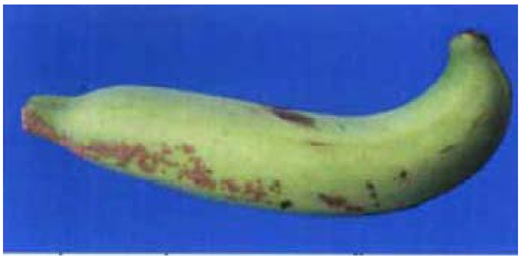

Figure C.16 A finger with scars due to thrips at the floral stage

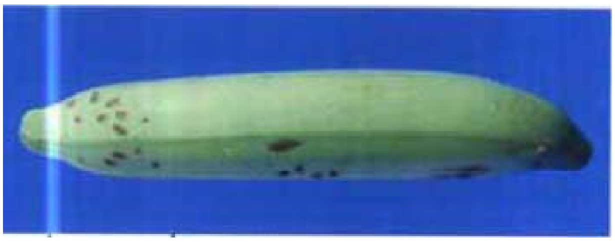

Figure C.17 — A finger with scars due to piercing insects

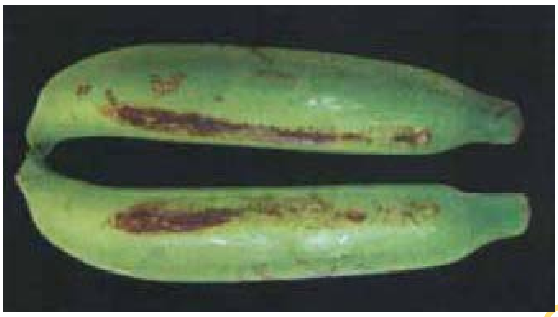

Figure C.18 Banana peels at the contacted fingers resulting reddish mark (acceptable)

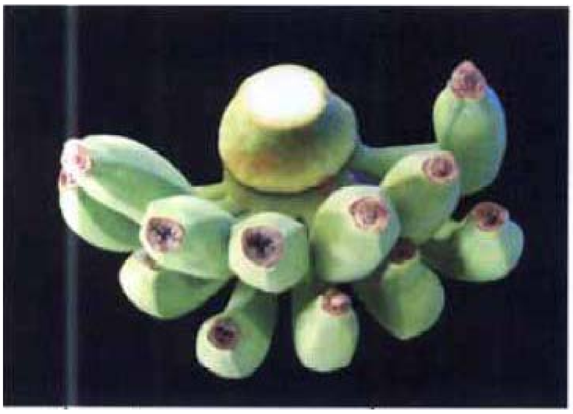

Figure C.19 — Appearance of cracks at the fruit ends (not acceptable)

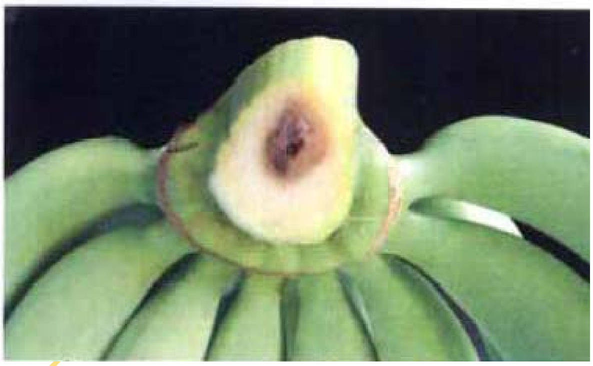

Figure C.20 Disease symptom of the last hand peduncle (acceptable after proper trimming)

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